

**CHARACTERIZATION OF THE LIFE
HISTORY AND ECOLOGY
OF THE HUMPBACK CHUB IN THE
GRAND CANYON**

**TRIP REPORT - 1990 TRIP 1
(October 15-27, 1990)**

Prepared For:

Bureau of Reclamation

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November 7, 1990

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INTRODUCTION

This reports presents pertinent details associated with 1990 Trip. 1. Included in the report are a summary of the trip logistics, personnel and research schedule, data collected, problems encountered, pertinent observations and recommendations. Most information is presented in a tabular format to provide a quick synopsis of pertinent trip details and results.

LOGISTICS, RESEARCH SCHEDULE AND PERSONNEL

Table 1 presents a summary of logistics and the research schedule for 1990, Trip 1. Table 2 presents personnel who were present or participated in research activities for 1990, Trip 1. AGFD personnel were generally involved with separate, concurrent research activities during the trip.

DATA COLLECTED

Table 3 presents a summary of gear types used, sampling effort and fish captured by gear type for 1990, Trip 1. Table 4 is a summary of all humpback chubs handled during 1990, Trip 1. Table 5 presents information on all humpback chubs radio-tagged during 1990, Trip 1.

Humpback Chubs Captured

A total of 45 humpback chub were handled during 1990, Trip 1. Data were collected on all of these fish with the exception of two adults that escaped as nets were being pulled into the boat. One additional adult humpback chub was trammel netted by AGFD in a backwater at RM 60.2. This fish was a recapture bearing PITTAG # 7F7F456E36 (fish was originally tagged by AGFD). The fish was processed and photographed by BIO/WEST for meristic information and released at RM 61.2

Five of the 43 humpback chubs processed by BIO/WEST were recaptures, bearing either Carlin or Floy tags. Recapture information, including tag type, color and number is presented in Table 4. All Floy tags and Carlin dangle tags were removed from recaptured fish and the fish were equipped with a PITTAG for future identification. Tags removed by BIO/WEST will be returned to AGFD with associated information for each fish.

Radiotelemetry

Ten humpback chubs were implanted with radio transmitters during 1990, Trip 1. All tags were implanted without complications and the fish were vigorous and in good condition at the time of release. All 10 fish were relocated and observed at least once following release, and showed no signs of aberrant behavior. All fish were actively moving both vertically and longitudinally and were judged to be showing no ill effects from implantation.

Table 1. Logistics and Research Schedule for Trip #1, 1990

DATE	RM	LOCATION	RESEARCH ACTIVITIES			
			T&R ¹	FS	TE	HQ
10/15	26.2	TIGER WASH	X			
10/16	61.2	LCR	X	X	X	
10/17	61.2	LCR		X	X	
10/18	61.2	LCR		X	X	
10/19	65.4	LAVA CANYON	X	X	X	
10/20	65.4	LAVA CANYON		X	X	
10/21	65.4	LAVA CANYON		X	X	
10/22	71.0	CARDENAS CREEK	X	X		
10/23	93.5	MONUMENT CREEK	X			
10/24	134.5	BONITA CREEK	X			
10/25	179.7	LOWER LAVA FALLS	X			
10/26	224.5	NEAR DIAMOND CR	X			
10/27	225.8	DIAMOND CREEK	X			

¹ T&R = Travel and Reconnaissance

FS = Fish Sampling

TE = Telemetry

HQ = Habitat Quantification

Table 2. Personnel Participating in Trip #1, 1990.

PERSONNEL	AFFILIATION	DATES	COMMENTS
W. Masslich	B/W	10/15-10/20	Out Tanner Trail
L. Crist	B/W	10/15-10/26	
B. Leibfried	B/W	10/15-10/27	
R. VanHaverbeke	B/W	10/15-10/27	
H. Yard	B/W	10/15-10/27	
G. Williams	B/W	10/15-10/26	
G. Doster	B/W	10/19-10/20	In/Out Tanner Trail
M. Yard	GCES	10/15-10/20	
D. Wegner	GCES	10/19-10/21	Out Tanner Trail
D. Kubly	AGFD	10/15-10/21	Out Tanner Trail
R. Clarkson	AGFD	10/15-10/27	
B. Bagley	AGFD	10/15-10/27	
B. Davis	CREDA	10/15-10/27	
B. Durker	OARS	10/15-10/27	
J. Brown	OARS	10/15-10/27	

Table 3. Summary of Fish Collected and Effort by Gear Type.										
¹	²	HB	FM	BH	SD	RB	BR	CC	CP	SB
EL N=19 4.87 hr	A	1	3	0	0	83	2	3	10	0
	J	1	0	0	0	13	0	0	0	0
	Y	0	0	0	0	2	0	0	0	0
TL N=23 58.2 hr	A	17	3	0	0	12	4	0	0	0
	J	1	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0
TK N=13 33.4 hr	A	7	0	0	0	2	0	0	0	0
	J	5	0	0	0	1	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0
GM N=16 40.9 hr	A	2	2	0	0	4	1	0	1	0
	J	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0
GP N=22 53.2 hr	A	10	3	0	0	7	1	0	0	0
	J	1	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0
GX N=6 14.7 hr	A	0	0	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0
TOTAL	A	37	11	0	0	108	8	3	11	0
	J	8	0	0	0	14	0	0	0	0
	Y	0	0	0	0	2	0	0	0	0

¹ - Gear Types

EL = Electrofishing

TL = 75'x6'x1½"x12" trammel net

TK = 75'x5'x1"x12" trammel net

GM = 10'x6'x2" gill net

GP = 100'x6'x1½" gill net

GX = 100', 2" to ½" @ ½ increment, experiment gill net

² - A = Adult

J = Juvenile

Y = Young of year

Table 4. Summary of Humpback Chub handled during Trip #1, 1990.

Page 5.									
#	DATE	GEAR ^c TYPE	PIT TAG	RECAP	OLD TAG	TL (mm)	WT (g)	RM (capture)	RM (release)
1	10/17/90	GP	7F7F3E3454	Y	0315176 ⁴	355	430	60.4	60.4
2	10/17/90	GP	7F7F3F3626 ^A	Y	068 ⁵	432	780	60.4	60.4
3	10/17/90	GP	7F7F3F441C	N	-	353	370	60.4	60.4
4	10/17/90	GP	7F7F3E3370	N	-	329	515	60.4	60.4
5	10/17/90	GP	7F7F3E2D2D ^A	N	-	439	865	60.4	60.4
6	10/17/90	TL	7F7F3F5050 ^A	N	-	428	840	60.2	60.4
7	10/17/90	TL	7F7F3E2253 ^A	N	-	382	535	60.2	60.4
8	10/17/90	TL	7F7F3E4067	N	-	365	530	60.2	60.4
9	10/18/90	GP	7F7F3F4054 ^A	Y	305673 ³	415	720	60.4	60.5
10	10/18/90	GP	7F7F3E2A49	N	-	332	405	60.4	61.2
11	10/18/90	GP	7F7F3F452E	N	-	382	510	60.4	61.2
12	10/18/90	GP	7F7F3F396A	N	-	374	690	60.4	61.2
13	10/18/90	TL	7F7F3F5044 ^A	N	-	388	580	60.6	60.5
14	10/18/90	TL	7F7F450272	N	-	451	790	60.2	61.2
15	10/18/90	TL	7F7F3F4577	N	-	367	495	60.2	61.2
16	10/18/90	TL	7F7F3C4554	N	-	413	800	60.2	61.2
17	10/19/90	GM	7F7F451157	N	-	392	540	65.4	65.5
18	10/19/90	GM	- FISH ESCAPED -			-	-	65.4	
19	10/19/90	GP	- ESCAPED -			-	-	64.6	-

Table 4. Summary of Humpback Chub handled during Trip #1, 1990.

Page 6.

#	DATE	GEAR ^c TYPE	PIT TAG	RECAP	OLD TAG	TL (mm)	WT (g)	RM (capture)	RM (release)
20	10/19/90	TK	7F7F3F4F47	N	-	240	160	65.2	65.5
21	10/19/90	TK	7F7F3C3F16	N	-	260	160	65.2	65.5
22	10/19/90	TK	7F7F3E271F	N	-	340	400	65.2	65.5
23	10/19/90	TK	7F7F3F4F30	N	-	287	215	65.2	65.5
24	10/19/90	TK	7F7F3C2925	N	-	223	94	65.2	65.5
25	10/19/90	TL	7F7F3F4747	N	-	344	350	64.6	65.5
26	10/19/90	TL	7F7F3E2B52	N	-	332	370	64.6	65.5
27	10/19/90	TL	7F7F3F4E11 ^A	N	-	376	465	64.6	65.5
28	10/19/90	TL	7F7F3C2419	Y	360 ²	355	440	64.6	65.5
29	10/20/90	GM	7F7F3C2B55	N	-	405	745	65.4	65.5
30	10/20/90	GP	7F7F3E3E51	N	-	325	320	64.6	65.5
31	10/20/90	TK	7F7F3C2B56	N	-	342	455	65.0	65.5
32	10/20/90	TK	7F7F3E2F3A ^A	Y	0314021 ¹	367	500	65.0	65.5
33	10/20/90	TL	7F7F3E2E29	N	-	404	550	64.6	65.5
34	10/20/90	TL	7F7F3C311C ^A	N	-	395	525	64.6	65.5
35	10/20/90	TL	7F7F456B2C ^A	N	-	390	605	64.6	65.5
36	10/20/90	TL	7F7F3F5043	N	-	334	405	64.6	65.5
37	10/21/90	EL	7F7F3C3A12	N	-	372	410	65.0	65.5
38	10/21/90	EL	-	N	-	100	8	65.0	65.0

Table 4. Summary of Humpback Chub handled during Trip #1, 1990.

Page 7.									
#	DATE	GEAR ^c TYPE	PIT TAG	RECAP	OLD TAG	TL (mm)	WT (g)	RM (capture)	RM (release)
39	10/21/90	TK	7F7F3F4C73	N	-	297	312	65.0	65.5
40	10/21/90	TK	7F7F3F480D	N	-	398	638	65.0	65.5
41	10/21/90	TK	7F7F3F4E06	N	-	341	140 ^B	65.0	65.5
42	10/21/90	TK	7F7F3E3804	N	-	290	270	65.0	65.5
43	10/21/90	TK	7F7F3C3956	N	-	221	116	65.0	65.5
44	10/21/90	TL	7F7F3C3000	N	-	203	58	65.0	65.5
45	10/21/90	TL	7F7F3F4B71	N	-	334	345	65.0	65.5

1- Yellow Floy tag - AGFD

2- Small Yellow Carlin

3- Orange Floy - AGFD

4- Yellow Floy - AGFD

5- Small Orange Carlin Tag

A- Fish implanted with radio transmitter

B- Probable misreading

C- Gear Types

EL = Electrofishing

TL = 75'x6'x1½"x12" trammel net

TK = 75'x5'x1"x12" trammel net

GM = 10'x6'x2" gill net

GP = 100'x6'x1½" gill net

GX = 100', 2" to ½" @ ½ increment, experiment gill net

Table 5. Summary of radio-transmitter implants in humpback chub during Trip #1, 1990.

#	DATE	PITTAG	TL	WT	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (gms)	LIFE EXPEC- TANCY (days)	DATE OF EXTINCTION	CAPTURE (mm)	RELEASE (mm)
1	10/17/90	7F7F3F5050	428	840	40.670	60	11	100	910125	60.2	60.4
2	10/17/90	7F7F3E2D2D	439	865	40.640	59	11	100	910125	60.4	60.4
3	10/17/90	7F7F3F3626	432	780	40.620	78	11	75	901231	60.4	60.4
4	10/17/90	7F7F3E2253	382	535	40.650	81	11	75	901231	60.2	60.4
5	10/18/90	7F7F3F4054	415	720	40.630	39	9	50	901207	60.4	60.5
6	10/18/90	7F7F3F5044	388	580	40.680	77	11	75	910101	60.6	60.5
7	10/19/90	7F7F3F4E11	376	465	40.690	40	9	50	901208	64.6	64.9
8	10/20/90	7F7F3E2F3A	367	500	40.660	39	9	50	901209	64.6	64.7
9	10/20/90	7F7F456B2C	390	605	40.610	58	11	100	910128	64.6	64.7
10	10/20/90	7F7F3C311C	395	525	40.600	40	9	50	901210	64.6	64.7

Table 5. Summary of radio-transmitter implants in humpback chub during Trip #1, 1990.

#	DATE	PITTAG	TL	WT	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (gms)	LIFE EXPEC- TANCY (days)	ESTIMATED DATE OF EXTINCTION	CAPTURE (rm)	RELEASE (rm)
1	10/17/90	7F7F3F5050	428	840	40.670	60	11	100	01/25/91	60.2	60.4
2	10/17/90	7F7F3E2D2D	439	865	40.640	59	11	100	01/25/91	60.4	60.4
3	10/17/90	7F7F3F3626	432	780	40.620	78	11	75	12/31/90	60.4	60.4
4	10/17/90	7F7F3E2253	382	535	40.650	81	11	75	12/31/90	60.2	60.4
5	10/18/90	7F7F3F4054	415	720	40.630	39	9	50	12/07/90	60.4	60.5
6	10/18/90	7F7F3F5044	388	580	40.680	77	11	75	01/01/91	60.6	60.5
7	10/19/90	7F7F3F4E11	376	465	40.690	40	9	50	12/08/90	64.6	64.9
8	10/20/90	7F7F3E2F3A	367	500	40.660	39	9	50	12/09/90	64.6	65.5
9	10/20/90	7F7F456B2C	390	605	40.610	58	11	100	01/28/91	64.6	65.5
10	10/20/90	7F7F3C311C	395	525	40.600	40	9	50	12/10/90	64.6	65.5

OBSERVATIONS

1. All chubs handled appeared robust, vigorous and in good condition.
2. A significant number of rainbow trout handled were emaciated to varying degrees and generally appeared in poor to fair condition.
3. Under stable 8000 cfs flows in October, netting with gill and trammel nets provides an effective means of collecting adult and large juvenile humpback chubs in the main stem Colorado River near the confluence of the Little Colorado River.
4. Under clear water conditions, most humpback chubs were captured during the nocturnal period, beginning approximately 2 hours following sunset. This trend was consistent for electrofishing and netting during Trip 1.
5. Under turbid conditions, humpback chubs were captured during the diurnal period, indicating possible increased activity during higher turbidity.
6. Limited contacts with recently radio-tagged fish suggested that the fish move to deeper places in the river channel during the day light period in clear water. Radio telemetry information also indicated that the fish move higher in the water column in the nocturnal period and during higher turbidity.
7. Juvenile humpback chubs were only captured below the confluence of the Little Colorado River. All humpback chubs captured above the confluence of the Little Colorado River were adults.
8. All radio-tagged fish were located following release and appeared active within proximity of release point.

PROBLEMS ENCOUNTERED

1. Compilation of extensive meristic data required that humpback chub be held for excessive periods of time, resulting in additional stress to the fish.
2. Errant radio transmissions within the vicinity of the confluence of the Little Colorado River, intermittently jammed frequencies within the working range of radio transmitters used in this study. Frequencies affected include: 40.690; 40.700 - 40.740. Source of transmissions are unknown at this time.
3. Damage to outboard motors occurred during navigation of whitewater sections within the study area. One outboard motor was completely disabled and one sustained slight damage to lower unit.
4. Extensive night work associated with the nocturnal activity of the humpback chubs during Trip 1 created minor problems associated with adequate marginal lighting for work and photography.
5. Use of only one 37' support raft resulted in: 1) overloading of support boat; 2) the need to use the sportboats to transport gear rather than piggy-backing the sportboats to the study location and; 3) inefficient rigging and de-rigging.
6. Potential duplication of sampling of backwaters during future Trips could adversely affect the research efforts of AGFD.
7. Collection of general water quality parameters associated with individual humpback chub captures was inefficient and unnecessary due to the stable nature of water quality in the main stem Colorado during Trip 1.

RECOMMENDATIONS

1. Reduce meristic data collection effort. We recommend subsampling 20% of humpback chubs captured for meristic data collection, not including radio-tagged fish.
2. Schedule and conduct a meeting of all researchers involved with humpback chub or aquatic research activities in the Grand Canyon. The main objectives of the meeting would be to coordinate research activities, information exchange and to reduce duplication of effort or unnecessary handling of the fish.
3. Research activities for the inner gorge river reach (Reach 2) should be initiated below Sockdolager Rapid (RM 79) to avoid running research vessels through both Hance and Sockdolager Rapids. This would reduce the sampling reach by only 1.3 miles and significantly reduce safety hazards and potential equipment loss due to the difficult nature of the two rapids. Inner gorge research activities would not be adversely affected since habitat in this reach is similar to that found below Sockdolager Rapid.
4. Adequate support boats should be made available to piggy-back research vessels to their respective study areas. This would increase safety, decrease potential for equipment damage or loss and reduce the impacts of motoring research vessels in the Canyon, particularly during non-motorized season.
5. Due to the temporal and spacial consistency in water quality, data should be collected and logged at given times each day at a specified location or locations, rather than taken at each point that a humpback chub is collected. Water quality sampling stations would be determined for each base camp and will account for the influence of tributaries. In addition to regular water quality observations, supplemental water quality data would be collected if deemed necessary, i.e. if significant changes in turbidity are noted.
6. Belknap's Grand Canyon River Guide, instead of Steven's guide, should be used for all BIO/WEST research activities beginning 1990, Trip 2. Topographic detail presented in Belknap's guide allows for more precision in determining 'on ground' locations associated with fish sampling and telemetry work.
7. We recommend that 10 humpback chubs be implanted during 1990, Trip 2 in November. This would increase the opportunity to test the viability of radiotelemetry early in the project. Additionally, with the stable 11,000 cfs flows that are anticipated during the 1990, Trip 3 (December), additional radiotagged fish would increase our ability to gather information on humpback chub behavior under stable flows that could be used as a baseline for comparison under fluctuating conditions.

APPENDIX A
DATA SHEETS FOR 1990, TRIP 1

**CHARACTERIZATION OF THE LIFE
HISTORY AND ECOLOGY
OF THE HUMPBAC CHUB IN THE
GRAND CANYON**

**TRIP REPORT #2 - 1990
November 14 - December 3, 1990**

Prepared For:

Bureau of Reclamation

Prepared By:

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December 17, 1990

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TABLE 4.	SUMMARY OF HUMPBACK CHUB HANDLED DURING TRIP #2, 1990.
TABLE 5a.	SUMMARY OF RADIO-TRANSMITTER IMPLANTS IN HUMPBACK CHUB DURING TRIP #1, 1990.
TABLE 5b.	SUMMARY OF RADIO-TRANSMITTER IMPLANTS IN HUMPBACK CHUB DURING TRIP #2, 1990.
TABLE 6.	A LIST OF RADIO FREQUENCIES CONTACTED ON TRIP #2, 1990, AND LOCATIONS RELATIVE TO CAPTURE AND RELEASE SITES.

INTRODUCTION

This report presents pertinent details associated with Trip #2, 1990. Included in the report are a summary of trip logistics, research schedule, personnel, data collected, observations, problems encountered and recommendations. Most information is presented in tabular format to provide a quick synopsis of pertinent trip details and results.

LOGISTICS, RESEARCH SCHEDULE AND PERSONNEL

Table 1 presents a summary of camp locations and research activities for Trip #2, 1990. Table 2 is a list of personnel on the trip as well as their affiliation.

DATA COLLECTED

Table 3 presents a summary of fish species captured by gear type and reach for Trip #2, 1990. Table 4 is a summary of all humpback chubs handled during the trip. Table 5a presents information on all humpback chubs radiotagged during Trip #1, 1990, while Table 5b presents information on all radiotagged chubs for Trip #2, 1990.

Humpback Chubs Captured

A total of 49 humpback chub were handled during Trip #2, 1990. Ten of the 49 humpback chubs processed were recaptures; 5 had either red, yellow or orange Carlin tags. Recapture information, including tag type, color and number is presented in Table 4. All Carlin dangle tags were removed from recaptured fish and the fish were equipped with a PIT tag for future identification. Tags removed by BIO/WEST will be returned to Arizona Game and Fish Department (AGFD) with associated information for each fish. One radiotagged chub (TL=407 mm, WT=825 g) was inadvertently released without a PIT tag.

Radiotelemetry

Seven humpback chubs were implanted with radio transmitters during Trip #2, 1990. All tags were implanted without complications and the fish were vigorous and in good condition at the time of release. All seven fish were relocated and observed at least once following release, and showed no signs of aberrant behavior. All fish were actively moving both vertically and longitudinally and were judged to be showing no ill effects from implantation.

Bench Marks

Three temporary bench marks were established in the Little Colorado River (LCR) area (Reach 1) for the purpose of measuring river stage change and relating it to movement of radiotagged fish. Each bench mark will eventually be correlated to one of the 50 permanent known elevation marks for determining absolute stage and flow changes.

Each bench mark is a 1 cm diameter dot of latex paint placed on a permanent rock above the high water mark. A given bench mark will be used to monitor stage change between hydraulic controls, e.g., between riffles or rapids.

The three bench marks are:

1. RMI 60.4, river left on a large rock near the upper end of the eddy; see map on back of radiotelemetry sample sheet #023.
2. RMI 60.8, river right on tapeats ledges at upper end of sand bar near deep backwater; see map on back of radiotelemetry sample sheet #023.
3. RMI 63.9, river left on large rock in rock group near upper end of eddy at base of salt cliffs; see map on back of radiotelemetry sample sheet #031.

OBSERVATIONS

1. All chubs handled appeared robust, vigorous and in good condition.
2. A large number of rainbow trout handled were emaciated to varying degrees and generally appeared in poor to fair condition, although the proportion of these fish was down from that observed on Trip #1, 1990.
3. Under fluctuating flows ($\approx 5,000 - 2,000$ cfs) in November, netting with gill and trammel nets proved an effective means for collecting adult and large juvenile humpback chubs in the mainstem Colorado River.
4. Under clear water conditions, most humpback chubs were captured during the crepuscular and nocturnal period. This trend was consistent for electrofishing and netting during Trips #1 and #2.
5. Humpback chubs were captured during the diurnal period only in the presence of high turbidity.
6. Contacts with previously radiotagged fish suggested that the fish move to deeper places in the river channel during the daylight period in clear water. Radiotelemetry information also indicated that the fish moved higher in the water column in the nocturnal period and during higher turbidity.
7. Juvenile humpback chubs were captured only below the confluence of the Little Colorado River during Trip #1. However, juveniles were captured above the LCR on Trip #2.
8. All radiotagged fish were located following release and appeared active within the proximity of release point.
9. Radiotagged humpback chub monitored over 24-hour periods occupied and returned to site-specific locations for extended periods.

10. Three humpback chub were captured in downstream reaches; two at Pumpkin Springs (RM 213.6) and one at Shinumu Creek (RM 108.3)

PROBLEMS ENCOUNTERED AND SOLUTIONS

1. Meristic data were collected from every tenth chub to alleviate excessive stress to the fish from handling.
2. Errant radio transmissions within the vicinity of the confluence of the Little Colorado River were attributed to the USGS gaging station and to the internal circuitry in the station hydrolab. These signals have intermittently jammed frequencies within the working range of radio transmitters used in this study. Frequencies affected include: 40.690; 40.700 - 40.740.
3. Damage to outboard motors occurred during navigation of whitewater sections within the study area. All three sustained damage to drive shafts and splines, but remained functional.
4. Extensive night work associated with the nocturnal activity of the humpback chubs during Trips #1 and #2 will require scheduled shift work by teams.
5. The volume of equipment carried on the 20-day trips strained the capacity of the two 33-foot and two 23-foot rafts. We are able to load only one of the five sportboats. Streamlining the equipment load will enable us to load more of the research boats on the support rafts and minimize risk to people and equipment.
6. Coordination with AGF for sampling of backwaters should alleviate the adverse effects on overlap in research programs from similar sampling modes.
7. Collection of general water quality parameters will be conducted at camp locations using recording DataSondes.
8. Specific location (nearest 0.1 river mile) is confusing because of slight discrepancies in Belknap's and Steven's River Guides and caused by different interpretations of tenth mile locations. As a solution, river guides with delineated 0.1 mile will be used together with the GCES MIPS system.
9. Temporary bench marks will be established between hydraulic controls (riffles, rapids) to relate fish movement to absolute stage change.
10. The reach of the mainstem near the LCR should be surveyed at different times of the day and night and under different turbidity conditions to evaluate occurrence of radiotagged chubs near the surface.
11. River miles will be delineated to the nearest 0.1 mile according to the scale presented by Larry Stevens. These river miles may be marked on the Belknap guide to take advantage of the contour lines and details presented.

RECOMMENDATIONS

1. Continue to photograph (still and video) each humpback chub captured and measure meristic on every tenth fish.
2. Release all humpback chub (radiotagged and PIT tagged) at their point of capture. On Trips #1 and 2, only radiotagged fish were returned to capture sites, while PIT tagged fish were released at camp sites. High fidelity for specific locations by these fish dictates that all chubs should be released at capture locations.
3. Electrofishing timing and procedure need to be refined to make it an effective tool for capturing chubs.
4. The Inner Gorge reach will be divided into strata to allow for randomized sampling.
5. BIO/WEST will need to better organize and reduce the volume of research equipment on trips.
6. On-going water quality parameters will be measured with DataSondes temporarily located at camp sites. More extensive characterization of water quality will come from the USGS gages.
7. A relationship will be developed for measuring turbidity, using a limnophotometer and a Sechi disk, so the Sechi disk can be used for field measurements.
8. A proposal for a pilot study to evaluate use of a nonlethal stomach pump has been submitted to FWS and AGF. The study involves sacrificing two adult humpback chub to evaluate effects on the pharyngeals and efficiency of stomach evacuation.
9. Length categories for life stage designations (i.e., larvae, YOY, juvenile, adult) will need to be developed to facilitate field determinations.

TABLES
TRIP #2, 1990

Table 1a. Camp Locations and Research Activities for Trip #2, 1990, Team #1.

DATE	RM	LOCATION	RESEARCH ACTIVITIES				
			O ¹	T&R	FS	TE	HQ
11/14	12.5	BELOW SALT WATER WASH		X			
11/15	61.2	LCR		X		X	
11/16	61.2	LCR	X			X	
11/17	61.2	LCR	X		X	X	
11/18	61.2	LCR	X		X	X	
11/19	61.2	LCR	X		X	X	
11/20	61.2	LCR				X	
11/21	65.4	LAVA CANYON		X	X	X	
11/22	65.4	LAVA CANYON			X	X	
11/23	65.4	LAVA CANYON					
11/24	65.4	LAVA CANYON			X		
11/25	73.7	BELOW UNKER			X		
11/26	73.7	BELOW UNKER			X		
11/27	119.5	BELOW 119-MILE CANYON			X		
11/28	168.1	FERN GLEN CANYON		X	X		
11/29	168.1	FERN GLEN CANYON			X		
11/30	198.5	PARASHONT WASH		X	X		
12/1	198.5	PARASHONT WASH			X		
12/2	220.1	220-MILE CANYON		X			
12/3	225.7	DIAMOND CREEK		X			

¹ O = Orientation and Instruction
T&R = Travel and Reconnaissance
FS = Fish Sampling
TE = Telemetry
HQ = Habitat Quantification

Table 1b. Camp Locations and Research Activities for Trip #2, 1990, Team #2.

DATE	RM	LOCATION	RESEARCH ACTIVITIES				
			O ¹	T&R	FS	TE	HQ
11/14	12.5	BELOW SALT WATER WASH		X			
11/15	61.2	LCR		X		X	
11/16	61.2	LCR	X			X	
11/17	61.2	LCR	X		X	X	
11/18	61.2	LCR	X		X	X	
11/19	61.2	LCR	X		X	X	
11/20	61.2	LCR				X	
11/21	87.2	CREMATION		X	X		
11/22	87.2	CREMATION			X		X
11/23	108.2	SHINUMU CREEK		X	X		
11/24	108.2	SHINUMU CREEK			X		X
11/25	143.4	KANAB CREEK		X	X		
11/26	143.4	KANAB CREEK			X		
11/27	155.6	LAST CHANCE		X	X		
11/28	155.6	LAST CHANCE			X		
11/29	168.1	FERN GLENN		X	X		
11/30	212.9	PUMPKIN SPRINGS		X	X		
12/1	212.9	PUMPKIN SPRINGS			X		X
12/2	220.1	220-MILE CANYON		X			
12/3	225.7	DIAMOND CREEK		X			

¹ O = Orientation and Instruction
T&R = Travel and Reconnaissance
FS = Fish Sampling
TE = Telemetry
HQ = Habitat Quantification

Table 2. Personnel Participating in Trip #2, 1990.

PERSONNEL	AFFILIATION	DATES	COMMENTS
TEAM #1			
R. Valdez	B/W	11/14-11/25	OUT TANNER TRAIL
B. Leibfried	B/W	11/14-12/3	
H. Yard	B/W	11/14-12/3	
G. Doster	B/W	11/14-12/3	
B. Elwinger	B/W	11/14-12/3	
M. Yard	GCES	11/14-12/3	
C. Geanious	OARS	11/14-12/3	
Pete Weiss	OARS	11/14-12/3	
Kelly Burke	OARS	11/14-12/3	
TEAM #2			
L. Crist	B/W	11/14-12/3	
R. VanHaverbeke	B/W	11/14-12/3	
E. Prats	B/W	11/14-12/3	
G. Williams	B/W	11/14-12/3	
C. Hansen	B/W	11/14-12/3	
Alan Hayden	GCES	11/14-12/3	
Brian Mitchell	OARS	11/14-12/3	
Butch Hutton	OARS	11/14-12/3	
Jan Kempster	OARS	11/14-12/3	
Mille Birdwell	OARS	11/14-12/3	

Table 3. Summary of Fish Collected and Effort by Gear Type. THESE DATA ARE PRELIMINARY Page 1

¹	²	HB ³	FM	BH	RB	BR	CC	CP	SD	BK	RK	FV
Reach 1 EL N=9 3.26 hr	A	3	0	0	93	5	0	11	0	0	1	0
	J	0	0	0	4	1	0	0	0	0	0	0
	Y	1	0	0	0	0	0	0	0	0	0	0
Reach 2 EL N=11 2.45 hr	A	0	1	0	110	22	0	16	1	0	0	0
	J	0	0	0	4	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 EL N=9 3.28 hr	A	0	1	0	31	2	0	55	0	1	0	0
	J	0	1	0	5	0	0	1	0	0	0	0
	Y	0	1	0	2	0	0	0	0	0	0	0
Reach 1 TL N=17 38.67 hr	A	11	0	0	24	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 2 TL N=49 116.37 hr	A	0	5	1	8	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 TL N=13 33.12 hr	A	2	1	0	0	0	5	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0

Table 3. Summary of Fish Collected and Effort by Gear Type. THESE DATA ARE PRELIMINARY Page 2

¹	²	HB ³	FM	BH	RB	BR	CC	CP	SD	BK	RK	FV
Reach 1 TK N=24 51.82 hr	A	12	4	1	17	1	0	1	0	0	0	0
	J	0	0	0	1	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 2 TK N=28 58.64 hr	A	1	5	1	8	1	1	0	0	0	0	0
	J	0	1	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 TK N=34 88.29 hr	A	1	0	0	2	0	0	6	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 1 GM N=5 10.36 hr	A	0	0	0	1	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 2 GM N=34 97.87 hr	A	0	3	0	0	0	1	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 GM N=19 51.80 hr	A	0	0	0	0	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0

Table 3. Summary of Fish Collected and Effort by Gear Type. THESE DATA ARE PRELIMINARY Page 3

¹	²	HB ³	FM	BH	RB	BR	CC	CP	SD	BK	RK	FV
Reach 1 GP N=29 71.78 hr	A	17	2	0	22	4	0	0	0	1	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 2 GP N=14 30.86 hr	A	0	1	0	15	2	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 GP N=16 43.50 hr	A	0	0	0	2	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 1 GX N=9 20.72 hr	A	1	6	0	7	0	0	0	0	0	0	1
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 2 GX N=1 2.13 hr	A	0	0	0	0	0	0	0	0	0	0	0
	J	0	1	0	1	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 GX N=1 18.56 hr	A	0	4	1	2	0	0	0	0	0	0	0
	J	0	2	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0

Table 3. Summary of Fish Collected and Effort by Gear Type. THESE DATA ARE PRELIMINARY Page 4

¹	²	HB ³	FM	BH	RB	BR	CC	CP	SD	BK	RK	FV
Reach 2 HL N=4 87.31 hr	A	0	0	1	2	0	0	0	0	1	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 3 HL N=6 43.1 hr	A	0	0	0	0	0	0	0	0	0	0	0
	J	0	0	0	0	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
Reach 2 HS N=4 61.73	A	0	0	0	13	2	0	0	0	0	0	0
	J	0	0	0	1	0	0	0	0	0	0	0
	Y	0	0	0	0	0	0	0	0	0	0	0
TOTAL	A	48	33	4	342	37	7	83	1	2	1	1
	J	0	5	0	15	1	0	1	0	0	0	0
	Y	1	1	0	2	0	0	0	0	0	0	0

¹. Gear Types

EL = Electrofishing
 TL = 75'x6'x1½"x12" trammel net
 TK = 75'x5'x1"x12" trammel net
 GM = 10'x6'x2" gill net
 GP = 100'x6'x1½" gill net
 GX = 100', 2" to ½" @ ½" increment, experiment gill net
 HL = Large hoop net (4'diameter)
 HS = Small hoop net (2' diameter)

² - A = Adult
 J = Juvenile
 Y = Young of year

³ - HB = humpback chub
 FM = flannelmouth sucker
 BH = bluehead sucker
 RB = rainbow trout
 BR = brown trout
 CC = channel catfish
 CP = carp
 SD = speckled dace

BK = brook trout
 RK = Rio Grande killifish
 FV = flannelmouth variant

Table 4. Summary of Humpback Chub handled during Trip #2, 1990.

Page 1.

#	DATE	GEAR TYPE ^c	PIT TAG	RECAP	OLD TAG	TL (mm)	WT (g)	RM (capture)	RM (release)
1	901116	GP	7F7F3F470E	N	-	343	385	60.1	61.2
2	901116	GP	7F7F3C303B ^A	Y	578 ¹	396	665	60.1	60.2
3	901116	GP	7F7F3F4B54	N	-	377	314	60.3	61.2
4	901116	GP	7F7F3F4C44	N	-	282	270	60.3	61.2
5	901116	GP	7F7F3F3B6A	N	-	331	340	60.3	61.2
6	901116	GP	7F7F3E2F26	N	-	370	565	60.1	61.2
7	901116	GP	7F7F3E2F28	N	-	352	410	60.1	61.2
8	901116	GP	7F7F3F4630	N	-	349	250	60.3	61.2
9	901116	GP	7F7F3E2720	N	-	355	465	60.3	61.2
10	901116	TL	7F7F3E2D41	Y	603 ²	294	270	60.4	61.2
11	901116	TL	7F7F3C6C11	Y	-	335	292	60.4	61.2
12	901116	TL	7F7F456643	Y	-	330	336	60.4	61.2
13	901116	TL	7F7F3E4105	N	-	361	392	60.4	61.2
14	901116	TL	7F7F3E4044	N	-	334	392	60.4	61.2
15	901116	TL	7F7F3C4452 ^A	N	-	404	672	60.4	60.4
16	901117	GP	7F7F3F4E77 ^A	N	-	407	675	61.0	61.0
17	901117	GP	7F7F451C79	Y	936 ³	311	270	61.0	61.2
18	901117	GP	7F7F3C4538	N	-	373	475	61.0	61.2

Table 4. Summary of Humpback Chub handled during Trip #2, 1990.

Page 2.

#	DATE	GEAR TYPE ^c	PIT TAG	RECAP	OLD TAG	TL (mm)	WT (g)	RM (capture)	RM (release)
19	901117	GP	7F7F3E2E73	N	-	390	520	61.0	61.2
20	901117	TK	7F7F3E3310	N	-	367	420	61.0	61.0
21	901117	TK	7F7F3E232E	N	-	360	289	61.1	61.1
22	901118	GP	7F7F3F4E02	N	-	382	502	61.0	61.2
23	901118	TK	7F7F3E2B6B	Y	316 ²	393	585	61.1	61.2
24	901118	TK	7F7F3C277A	N	-	294	252	61.1	61.2
25	901118	TL	7F7F3E3C5C ^A	N	-	422	798	61.1	61.1
26	901119	EL	-	N	-	143	25	62.0	62.0
27	901119	GP	NO PITTAG ^A	N	-	407	825	62.0	62.0
28	901119	GP	7F7F3C2F4B	N	-	359	330	62.0	62.0
29	901119	TK	7F7F3E2739	N	-	365	450	62.0	62.0
30	901119	TK	7F7F3E4105	Y	-	999 ^B	9999 ^B	61.5	61.5
31	901119	TK	7F7F43407F	N	-	405	645	61.5	61.5
32	901121	GX	7F7F3C4477	N	-	380	519	64.2	64.2
33	901121	TK	7F7F3F4802	Y	113 ²	368	604	64.3	65.5
34	901121	TK	7F7F3E2D14	N	-	390	537	64.3	65.5
35	901121	TK	7F7F450E4C	N	-	363	488	64.3	65.5
36	901121	TK	7F7F3C2919 ^A	N	-	394	635	64.1	64.1

Table 4. Summary of Humpback Chub handled during Trip #2, 1990.

#	DATE	GEAR TYPE ^c	PIT TAG	RECAP	OLD TAG	TL (mm)	WT (g)	RM (capture)	RM (release)
37	901122	EL	-	N	-	96	7	64.8	65.5
38	901122	EL	7F7F3C4455	N	-	263	221	64.8	65.5
39	901122	EL	7F7F3E317C	N	-	303	257	64.8	64.8
40	901122	TK	7F7F3E290D	N	-	335	274	64.4	65.5
41	901122	TL	7F7F3C3F17	N	-	338	367	64.6	65.5
42	901123	GP	7F7F45574B	N	-	363	562	64.9	64.9
43	901123	TK	7F7F451644	N	-	225	125	108.3	108.4
44	901123	TL	7F7F3C264C	N	-	352	520	64.4	65.5
45	901123	TL	7F7F3C4162 ^A	N	-	402	732	64.4	64.4
46	901124	TL	7F7F3C4477	Y	-	380	497	65.4	65.5
47	901130	TL	7F7F3E3212	N	-	318	280	213.6	213.6
48	901201	TK	7F7F3E3212	Y	-	318	257	212.5	212.5
49	901201	TL	7F7F3F4B6C	N	-	330	280	213.6	212.8

1=Small red carlin tag
 2=Small yellow carlin tag
 3=Small orange carlin tag
 A=Fish implanted with radio transmitter
 B=No measurements taken (recapture)
 C=Gear Types

EL = Electrofishing
 TL = 75'x6'x1½"x12" trammel net
 TK = 75'x5'x1"x12" trammel net
 GM = 10'x6'x2" gill net
 GP = 100'x6'x1½" gill net
 GX = 100', 2" to ½" @ ½ increment, experiment gill net

Table 5a. Summary of radio-transmitter implants in humpback chub during Trip #1, 1990.

#	DATE	PITTAG	TL (mm)	WT (g)	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (g)	LIFE EXPEC- TANCY (days)	DATE OF EXTINCTION	CAPTURE (RM)	RELEASE (RM)
1	10/17/90	7F7F3F5050	428	840	40.670	60	11	100	910125	60.2	60.4
2	10/17/90	7F7F3E2D2D	439	865	40.640	59	11	100	910125	60.4	60.4
3	10/17/90	7F7F3F3626	432	780	40.620	78	11	75	901231	60.4	60.4
4	10/17/90	7F7F3E2253	382	535	40.650	81	11	75	901231	60.2	60.4
5	10/18/90	7F7F3F4054	415	720	40.630	39	9	50	901207	60.4	60.5
6	10/18/90	7F7F3F5044	388	580	40.680	77	11	75	910101	60.6	60.5
7	10/19/90	7F7F3F4E11	376	465	40.690	40	9	50	901208	64.6	64.9
8	10/20/90	7F7F3E2F3A	367	500	40.660	39	9	50	901209	64.6	64.7
9	10/20/90	7F7F456B2C	390	605	40.610	58	11	100	910128	64.6	64.7
10	10/20/90	7F7F3C311C	395	525	40.600	40	9	50	901210	64.6	64.7

Table 5a. Summary of radio-transmitter implants in humpback chub during Trip #1, 1990.

#	DATE	PITTAG	TL (mm)	WT (g)	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (g)	LIFE EXPEC- TANCY (days)	DATE OF EXTINCTION	CAPTURE (RM)	RELEASE ¹ (RM)
1	10/17/90	7F7F3F5050	428	840	40.670	60	11	100	910425	60.2	60.2
2	10/17/90	7F7F3E2D2D	439	865	40.640	59	11	100	910125	60.4	60.4
3	10/17/90	7F7F3F3626	432	780	40.620	78	11	75	901231	60.4	60.4
4	10/17/90	7F7F3E2253	382	535	40.650	81	11	75	901231	60.2	60.2
5	10/18/90	7F7F3F4054	415	720	40.630	39	9	50	901207	60.4	60.4
6	10/18/90	7F7F3F5044	388	580	40.680	77	11	75	910101	60.6	60.6
7	10/19/90	7F7F3F4E11	376	465	40.690	40	9	50	901208	64.6	64.6
8	10/20/90	7F7F3E2F3A	367	500	40.660	39	9	50	901209	64.6	65.6
9	10/20/90	7F7F456B2C	390	605	40.610	58	11	100	910128	64.6	65.6
10	10/20/90	7F7F3C311C	395	525	40.600	40	9	50	901210	64.6	65.6

¹ - Release locations were the same as capture locations; adjustments were made to this table from Trip Report #1.

Table 5b. Summary of radio-transmitter implants in humpback chub during Trip #2, 1990.

#	DATE	PITTAG	TL (mm)	WT (g)	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (g)	LIFE EXPECTANCY (days)	ESTIMATED DATE OF EXTINCTION	CAPTURE (RM)	RELEASE (RM)
1	11/16/90	7F7F3C4452	404	670	40.600	62	11	100	02/23/91	60.4	60.4
2	11/16/90	7F7F3C303B	396	665	40.700	62	11	100	02/23/91	60.1	60.1
3	11/17/90	7F7F3F4E77	407	675	40.710	79	11	75	01/30/91	61.0	61.0
4	11/18/90	7F7F3E3C5C	422	798	40.730	61	11	75	01/31/91	61.1	61.1
5	11/19/90	NO PITTAG	407	825	40.740	79	11	75	02/01/91	62.0	62.0
6	11/21/90	7F7F3C2919	394	635	40.640	78	11	75	02/03/91	64.1	64.1
7	11/23/90	7F7F3C4162	402	732	40.630	62	11	100	02/29/91	64.4	64.4

Table 6. A list of radio frequencies contacted on Trip #2, 1990, and locations relative to capture and release sites.

Page 1

-----River Mile-----					
FREQ/PULSE	TAG SIZE (g)	DATE (time)	CAPTURE	RELEASE	LOCATE
40.600/40	9	10/20/90 11/17/90 (0910) 11/17/90 (1421) 11/17/90 (2131) 11/21/90 (1516) 11/23/90 (1130)	64.6	64.6	64.6 64.6 64.6 63.9 64.8
40.610/58	11	10/20/90 11/16/90 (0805) 11/17/90 (0900) 11/17/90 (1415) 11/17/90 (2131)	64.6	64.6	64.7 64.6 ≈ 64.4 64.6
40.660/39	9	10/20/90 11/16/90 (0815) 11/17/90 (1426) 11/17/90 (2131) 11/21/90 (1232) 11/21/90 (1712) 11/22/90 (1640)	64.6	64.6	64.8 64.5 64.6 64.8 64.8 64.8
40.680/77	11	10/18/90 11/24/90 (2230)	60.6	60.5	60.6
40.670/60	11	10/17/90 11/17/90 (0800) 11/17/90 (1339) 11/17/90 (1358) 11/17/90 (1432) 11/17/90 (2029) 11/18/90 (1420) 11/21/90 (1051) 11/24/90 (1630) 11/24/90 (2228)	60.2	60.4	60.4 60.4 60.6 60.5 60.6 60.5 60.5 60.3 60.3
40.690/40	9	10/19/90 11/16/90 (0817) 11/17/90 (1428) 11/17/90 (2131)	64.6	64.9	64.9 64.7 64.6

Table 6. A list of radio frequencies contacted on Trip #2, 1990, and locations relative to capture and release sites.

Page 2

-----River Mile-----					
FREQ/PULSE	TAG SIZE (g)	DATE (time)	CAPTURE	RELEASE	LOCATE
40.620/78	11	10/17/90 11/17/90 (2027) 11/17/90 (2035) 11/18/90 (1557) 11/18/90 (1706) 11/19/90 (2350) 11/20/90 (0700)	60.4	60.4	60.4 60.7 60.8 60.8 60.8 60.4
40.640/59	11	10/17/90 11/17/90 (2029) 11/24/90 (2225)	60.4	60.4	60.6 60.6
40.700/62	11	11/16/90 (2200) 11/17/90 (0800) 11/17/90 (1330)	60.1	60.1	60.4 60.4
40.710/78	11	11/17/90 (2200) 11/18/90 (1430) 11/24/90 (1648) 11/24/90 (2208)	61.0	61.0	61.0 60.8 60.8
40.730/61	11	11/18/90 (2200) 11/21/90 (1113) 11/24/90 (2200)	61.1	61.1	61.0 60.8
40.740/78	11	11/19/90 (2115) 11/21/90 (1128) 11/21/90 (1030)	62.0	62.0	62.0 62.0
40.600/62	11	11/16/90 (2200) 11/17/90 (0800) 11/17/90 (1339) 11/17/90 (1435) 11/17/90 (2029)	60.4	60.4	60.4 60.4 60.4 60.6
40.640/78	11	11/21/90 (2130) 11/24/90 (2130) 11/22/90 (1600)	64.1	64.1	64.1 64.0
40.630/62	11	11/23/90 (2130) 11/24/90 (2120)	64.4	64.4	64.3



**CHARACTERIZATION OF THE LIFE
HISTORY AND ECOLOGY
OF THE HUMPBACK CHUB IN THE
GRAND CANYON**

**TRIP REPORT #3 - 1990
December 12 - December 20, 1990**

Prepared For:

Bureau of Reclamation

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- TABLE 4. SUMMARY OF RADIOTELEMETRY INFORMATION COLLECTED DURING PREVIOUS TRIPS, 1990 AND CURRENT STATUS OF RADIOTAGGED HUMPBACK CHUBS.

APPENDIX A - DATA SHEETS FOR TRIP #2, 1990

INTRODUCTION

This report presents pertinent details associated with Trip #3, 1990. Included in the report are a summary of trip logistics, research schedule, personnel, data collected, observations, problems encountered and recommendations. Most information is presented in tabular format to provide a quick synopsis of pertinent trip details and results. Trip #3 was an abbreviated 10 day research trip. The primary purpose of the trip was to locate and monitor radio-implanted humpback chubs in Reach 1 (LCR) of the study area.

LOGISTICS, RESEARCH SCHEDULE AND PERSONNEL

Table 1 presents a summary of camp locations and research activities for Trip #3, 1990. Table 2 is a list of personnel on the trip as well as their affiliation.

DATA COLLECTED

Data was only collected using radiotelemetry during Trip #3, 1990. No fish sampling was conducted. Collection of radiotelemetry data was done using three primary methods including 24-hour monitoring of radio-tagged chubs, 2-hour monitoring of radio-tagged chubs and telemetry surveillance. An aerial telemetry survey was also conducted one day prior to the launch date (12/11/90). Table 3a presents information on all humpback chubs radiotagged during Trip #1, 1990, while Table 3b presents information on all humpback chubs radiotagged during Trip #2, 1990.

Radiotelemetry

A summary of radiotelemetry data collected during Trip #3, 1990 is presented in Table 4. Of the 17 fish implanted by BIO/WEST on the previous two trips, 11 fish were contacted. Three additional fish may have been contacted (two from air and one from boat), but the contacts only occurred once and consisted of only one pulse. Neither the identity or specific location of these two fish could be verified, so the contacts were categorized as a "possible". Three of the 17 fish were not contacted.

An aerial telemetry survey of Reach 1, by helicopter, was conducted one day prior to the launch of Trip #3. Based on earlier behavior patterns observed for radio-tagged humpback chubs, an early morning flight was chosen to survey fish as near as possible to day break. Contacts were made on six frequencies during the aerial survey. All contacts consisted of intermittent hits at one to several locations. No contacts could be verified by pulse counts. Only one contact made during the aerial survey corresponded with a subsequent on the ground location.

Twenty-four hour monitoring was conducted on 3 fish, 1 during fluctuating flows and 2 during stable 5000 cfs flows. Two-hour monitoring was conducted on 3 fish. Movements and surface habitat features were mapped for all two-hour and 24-hour monitoring efforts.

The objective of telemetry surveillance during Trip #3, 1990 was to assess diel behavior patterns of radio-tagged humpback chubs. Surveillance runs were conducted during daylight, night, dawn and dusk periods. Two surveillance runs were conducted during each the daylight and night periods during random time blocks. One surveillance run was conducted during each the dawn and dusk period.

Possible sites remote telemetry stations were investigated. Two sites were tentatively selected based on their proximity to a relatively shallow river reach. One site is located immediately above the LCR on river left and one approximately 0.2 miles below the LCR on river right. No other suitable sites were identified.

Bench Marks

Four temporary bench marks were established in the Little Colorado River (LCR) area (Reach 1) for the purpose of measuring river stage change and relating it to movement of radiotagged fish. Each bench mark will eventually be correlated to one of the 50 permanent known elevation marks for determining absolute stage and flow changes.

Each bench mark is a 1 cm diameter dot of latex paint placed on a permanent rock above the high water mark. A given bench mark will be used to monitor stage change between hydraulic controls, e.g., between riffles or rapids.

The three bench marks are:

1. RM 60.0, river left on a underside of a tapeats boulder next to the eddy below 60 mile rapid. large rock near the upper end of the eddy.
2. RM 60.1, river right on tapeats boulder in boulder outwash below 60 mile rapid.
3. RM 60.9, river left.
4. RM 64.5, river right at the bottom of the pool at the bottom of the salt mine riffle.

OBSERVATIONS

1. Diel behavior patterns were not as apparent during Trip #3, 1990 as during the previous two trips.
2. Certain fish were found utilizing relatively shallow areas for periods of 2 to 3 days, and were consistently available for telemetry observations.
3. Radio-tagged chubs monitored over 24-hour periods during stable flows exhibited only localized movements within a specific locale.
4. All radio-tagged humpback chubs monitored for 2 or 24 hour periods appeared active and did not exhibit aberrant behavior.

PROBLEMS ENCOUNTERED AND SOLUTIONS

1. Aerial telemetry efforts were generally ineffective at identifying or locating radio-tagged chubs. Most radio contacts consisted of single pulse hits, that could not be recontacted during a second pass. These contacts were thought to be associated with radio-tagged fish, signal bounce, narrow band interference (errant signals) and antenna inefficiency. Antenna mounts will be redesigned for the next flight and different flight altitude and speed will be used and evaluated.
2. All research boats were piggy-backed on support boats to and from the LCR research area, resulting in minimal damage to research equipment.
3. Aerial photography (1:2,400) was used as a base map to delineate fish movements and locations in the river channel was beneficial. Larger scale photography (1:1,200) will be required for habitat mapping.
4. Limited sites are available for remote telemetry stations.
5. Narrow and broad band interference were encountered during both aerial and ground telemetry monitoring. The two frequencies seem to be affected most are 40.640 and 40.690.

RECOMMENDATIONS

1. Continue to use aerial photography base maps for telemetry monitoring. 1:2,400 scale photos should be used only to map radio-tagged fishes locations. 1:1,200 photography should be used as a base map for mapping radio-tagged fish movements and habitat utilization during 2-hour and 24-hour monitoring.
2. Evaluate feasibility and utility of aerial radio telemetry for at least one more trip.
3. Remote telemetry stations and tentative site locations should be evaluated further prior to establishing stations.
4. Continued effort should be made to resolve inconsistencies in river mile designations for purposes of accurate radiotelemetry monitoring.

TABLES
TRIP #3, 1990

Table 1. Logistics and Research Schedule for Trip #3, 1990

DATE	RM	LOCATION	RESEARCH ACTIVITIES			
			T&R ¹	FS	TE	HQ
12/12	33.8	Little Redwall	X			
12/13	61.2	LCR			X	X
12/14	61.2	LCR			X	X
12/15	61.2	LCR			X	X
12/16	61.2	LCR			X	X
12/17	76.0	Above Hance	X		X	X
12/18	119	Below 119-Mile Canyon	X			
12/19	168	Fern Glen Canyon	X			
12/20	225.5	Diamond Creek	X			

¹ T&R = Travel and Reconnaissance

FS = Fish Sampling

TE = Telemetry

HQ = Habitat Quantification

Table 2. Personnel Participating in Trip #3, 1990.

PERSONNEL	AFFILIATION	DATES	COMMENTS
B. Masslich	B/W	12/12-12/18	Out Bright Angel
B. Leibfried	B/W	12/12-12/18	Out Bright Angel
H. Yard	B/W	12/12-12/18	Out Bright Angel
E. Prats	B/W	12/12-12/18	Out Bright Angel
R. VanHaverbeke	B/W	12/12-12/20	
G. Williams	B/W	12/12-12/20	
Alan Haden	GCES	12/12-12/18	Out Bright Angel
Bill Davis	CREDA	12/12-12/18	Out Bright Angel
Mike Walker	OARS	12/12-12/20	
O'Conner Dale	OARS	12/12-12/20	
Anna Stanfield	OARS	12/12-12/20	

Table 3a. Summary of radio-transmitter implants in humpback chub during Trip #1, 1990.

#	DATE	PITTAG	TL (mm)	WT (g)	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (g)	LIFE EXPEC- TANCY (days)	DATE OF EXTINCTION	CAPTURE (RM)	RELEASE (RM)
1	10/17/90	7F7F3F5050	428	840	40.670	60	11	100	910125	60.2	60.4
2	10/17/90	7F7F3E2D2D	439	865	40.640	59	11	100	910125	60.4	60.4
3	10/17/90	7F7F3F3626	432	780	40.620	78	11	75	901231	60.4	60.4
4	10/17/90	7F7F3E2253	382	535	40.650	81	11	75	901231	60.2	60.4
5	10/18/90	7F7F3F4054	415	720	40.630	39	9	50	901207	60.4	60.5
6	10/18/90	7F7F3F5044	388	580	40.680	77	11	75	910101	60.6	60.5
7	10/19/90	7F7F3F4E11	376	465	40.690	40	9	50	901208	64.6	64.9
8	10/20/90	7F7F3E2F3A	367	500	40.660	39	9	50	901209	64.6	64.7
9	10/20/90	7F7F456B2C	390	605	40.610	58	11	100	910128	64.6	64.7
10	10/20/90	7F7F3C311C	395	525	40.600	40	9	50	901210	64.6	64.7

Table 3b. Summary of radio-transmitter implants in humpback chub during Trip #2, 1990.

#	DATE	PITTAG	TL (mm)	WT (g)	FREQ	PULSE RATE (pulses/min)	RADIOTAG SIZE (g)	LIFE EXPECT- ANCY (days)	ESTIMATED DATE OF EXTINCTION	CAPTURE (RM)	RELEASE (RM)
1	11/16/90	7F7F3C4452	404	670	40.600	62	11	100	02/23/91	60.4	60.4
2	11/16/90	7F7F3C303B	396	665	40.700	62	11	100	02/23/91	60.1	60.1
3	11/17/90	7F7F3F4E77	407	675	40.710	79	11	75	01/30/91	61.0	61.0
4	11/18/90	7F7F3E3C5C	422	798	40.730	61	11	75	01/31/91	61.1	61.1
5	11/19/90	NO PITTAG	407	825	40.740	79	11	75	02/01/91	62.0	62.0
6	11/21/90	7F7F3C2919	394	635	40.640	78	11	75	02/03/91	64.1	64.1
7	11/23/90	7F7F3C4162	402	732	40.630	62	11	100	02/29/91	64.4	64.4

Table 4. Summary of radiotelemetry information collected during previous trips, 1990, and current status of radiotagged humpback chubs.

#	DATE OF LAST LOCATION ¹	FREQ.	CURRENT PULSE ²	PREVIOUS PULSE ³	RM ⁴	CONTACTED ⁵	LOCATED ⁶	2HR ⁷	24HR ⁷
1	901214	40.670	64	60	60.3	Y	Y	Y	
2	901215	40.640	54	59	60.3	Y	Y		
3	901214	40.620	68	78	60.8	Y	Y	Y	
4	901017	40.650	NC	81	(60.4)	P	N		
5	901214	40.630	39	39	60.6	Y	Y		
6	901124	40.680	-	77	(60.6)	N	N		
7	901117	40.690	-	40	(64.6)	N	N		
8	901215	40.660	39	39	64.7	Y	Y		
9	901117	40.610	NC	59	(64.6)	P	N		
10	901217	40.600	38	40	64.8	Y	Y		Y
11	901215	40.600	64	62	59.9	Y	Y		Y
12	901117	40.700	NC	62	60.9	Y	N		
13	901217	40.710	82	79	60.8	Y	Y		Y
14	901216	40.730	60	61	60.8	Y	Y		
15	901121	40.740	NC	79	(62.0)	N	N		
16	901122	40.640	-	78	(64.0)	P	N		
17	901216	40.630	65	62	64.5	Y	Y	Y	

¹ Date of most recent location, from current trip or previous trips.

² Pulse counts from current trips, NC=not counted.

³ Pulse counts from most recent contact prior to current trip.

⁴ River mile of last location from current trip or previous trip.

⁵ Indicates if fish was contacted on current trip, Y=Yes, P=Possible, N=No.

⁶ Indicates if specific location of fish was determined during current trip.

⁷ Indicates whether 2-hour or 24-hour monitoring was conducted.

APPENDIX A

DATA SHEETS FOR TRIP #3, 1990

